TIII:

SUPERHETERODYNE RECEIVER

Unclassified

4 Hour Conference, W/ 7Hr PE1

Safety & Environmental Impact is "LOW"

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Terminal Learning Objective

Action: Given a schematic diagram, answer questions pertaining to Ckt operation, Transmitter & Receiver group concepts and signal tracing procedures.

Condition: W/O References.

Standard: Answer 7 of 10 written questions correctly as well as troubleshoot & locate a malfunction W/in ~~20~~ seconds minutes.

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Introduction

All electronic communications both in defense as well as the private sector are centered around the very basic transmitter & receiver groups.

This lesson will concentrate on the Receiver group w/ an overview in a block diagram of the transmitter group.

Overview

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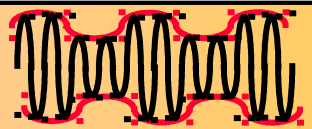
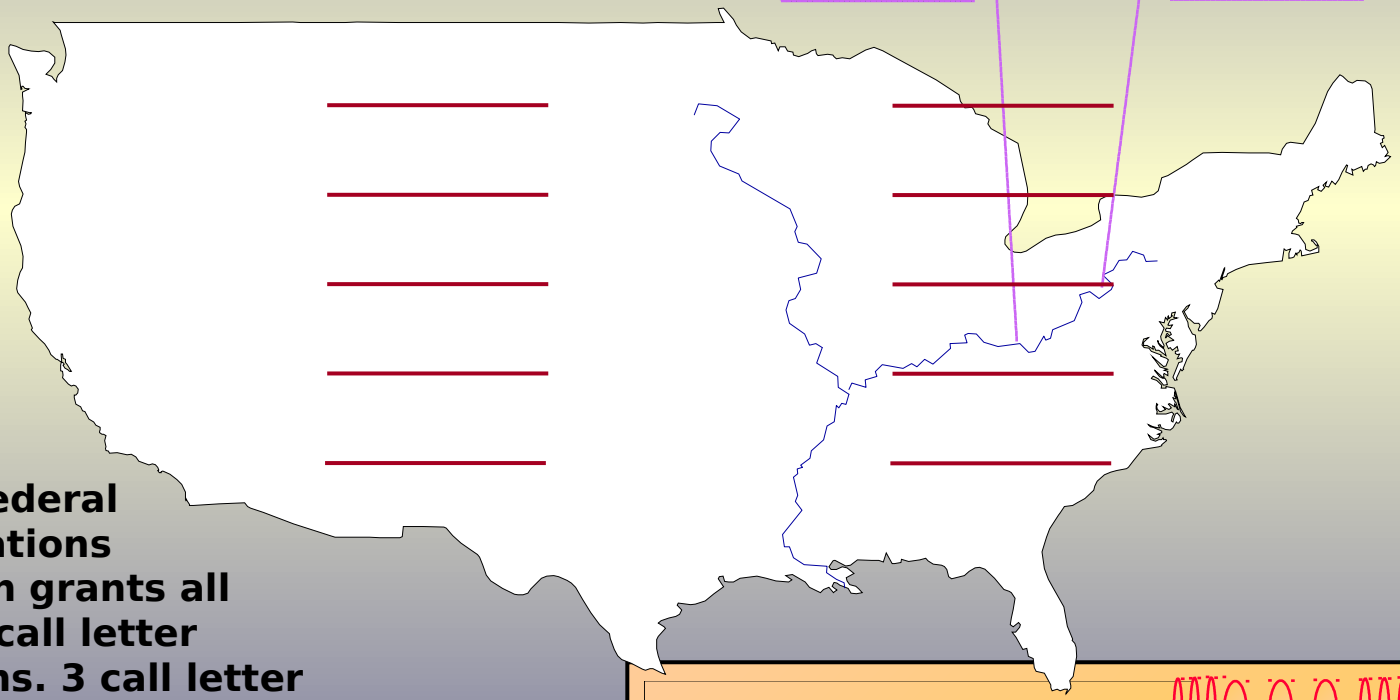
Overview;

AM ; Amplitude Modulated



WLW
Cincinnati OH.

KLT
Pittsburg Pa.



The FCC, Federal Communications Commission grants all License, & call letter designations. 3 call letter stations were grandfathered in due to there existence before the establishment of the FCC in 1932.

FM; Frequency Modulated

Transmitter Group

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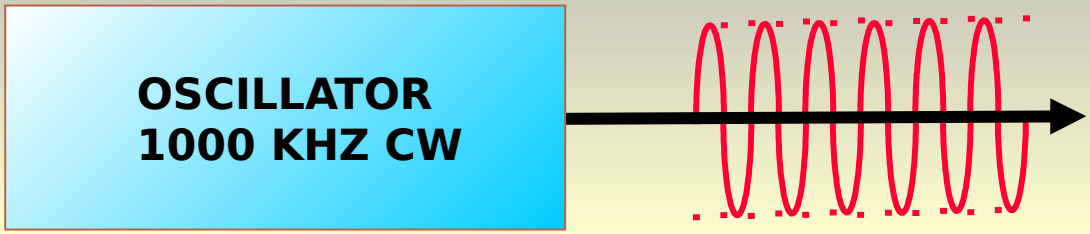
TRANSMITTER GROUP; OSCILLATOR



TRANSMITTER – Generates a continuous wave (CW) carrier frequency with an additional signal intelligence impressed upon it, thus becoming an Amplitude Modulated (AM) signal. Once powered up the AM signal is put on the air as transmission RF waves via an antenna.

Modulator

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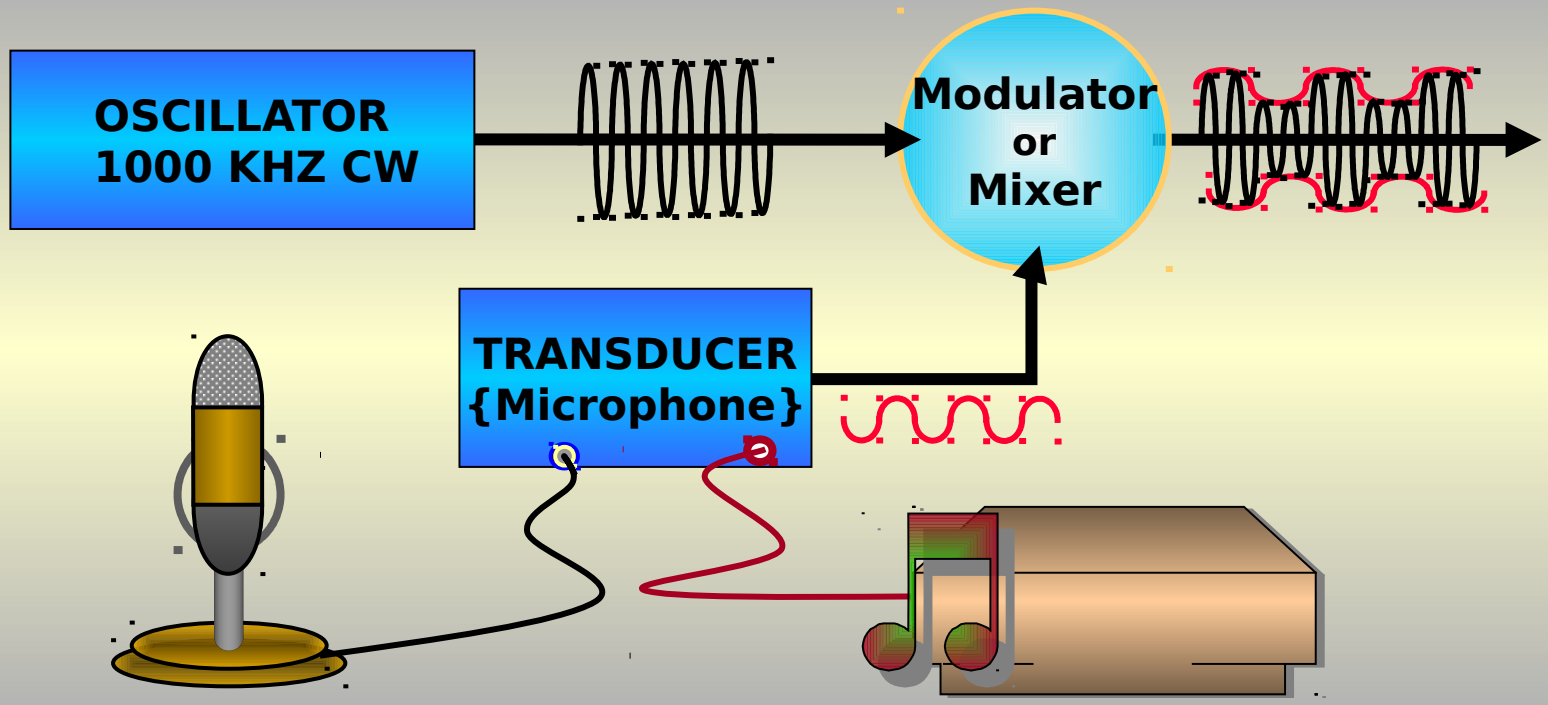
TRANSMITTER GROUP; MODULATOR



A. Input acquired from OSCILLATOR (1000 KHZ)
B. A 2nd signal from transducer is mixed with 1000 CW to produce and Amplitude Modulated (AM) signal or Carrier Transmission.

PWR Amp

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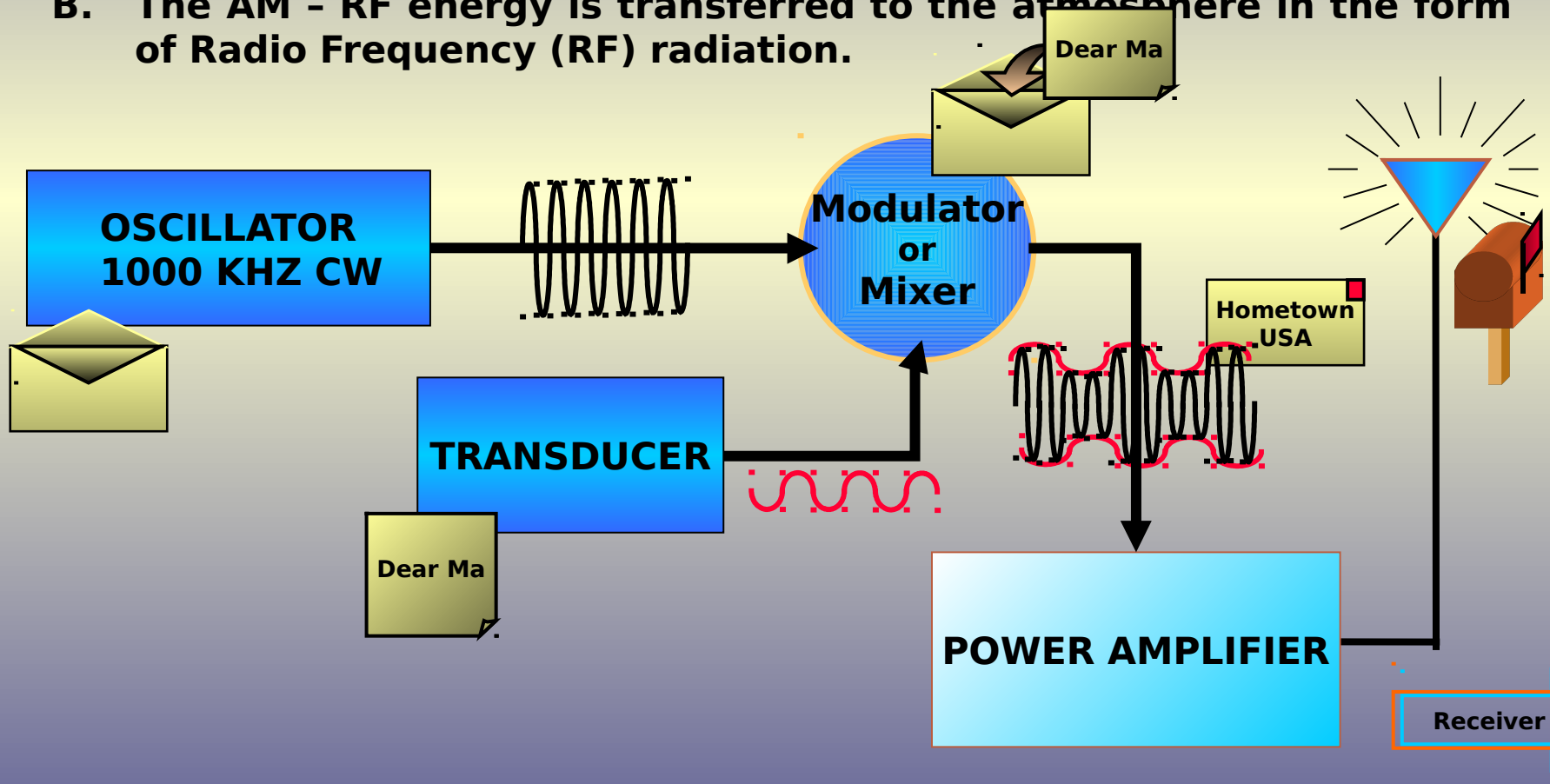
TRANSMITTER GROUP; POWER AMPLIFIER

A. Power Amplifier Boosts the AM signal up and applies it to the Antenna.

B. The AM – RF energy is transferred to the atmosphere in the form of Radio Frequency (RF) radiation.



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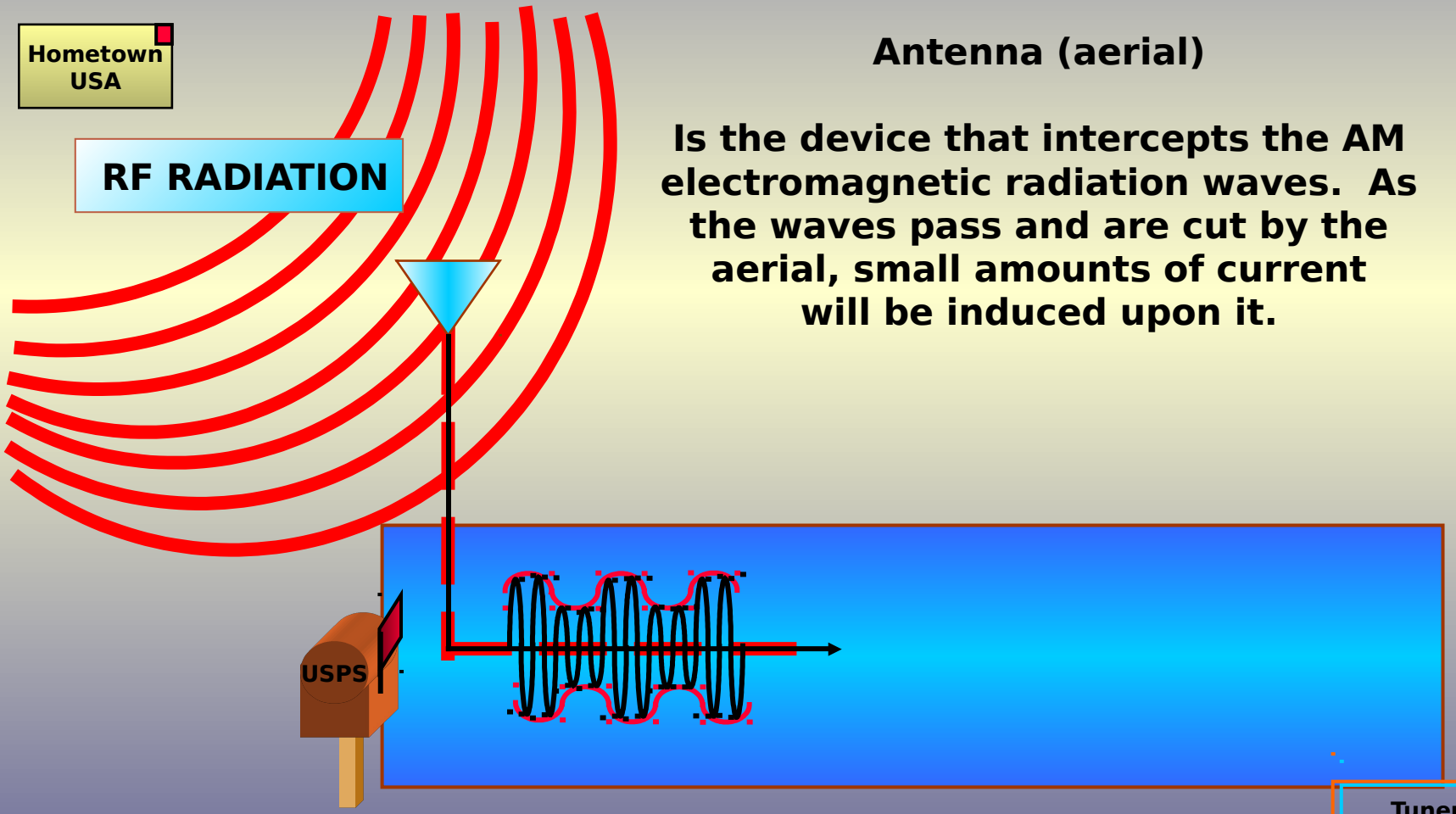
RECEIVER GROUP; ANTENNA



Antenna (aerial)

Is the device that intercepts the AM electromagnetic radiation waves. As the waves pass and are cut by the aerial, small amounts of current will be induced upon it.

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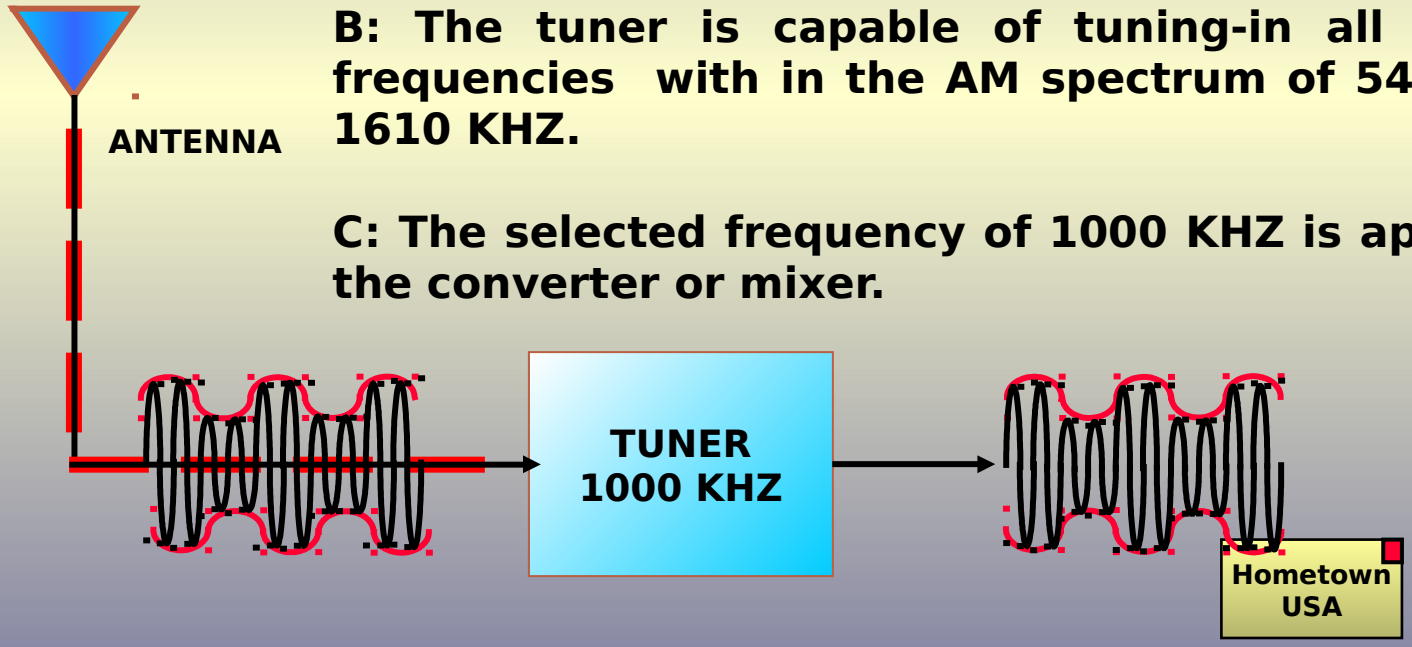
RECEIVER GROUP; TUNER

A: Selects one signal from the many on the aerial by tuning a Parallel LC Tank circuit to resonate @ 1000 KHZ.

B: The tuner is capable of tuning-in all the AM frequencies with in the AM spectrum of 540 KHZ – 1610 KHZ.

C: The selected frequency of 1000 KHZ is applied to the converter or mixer.



Tuner PC 38

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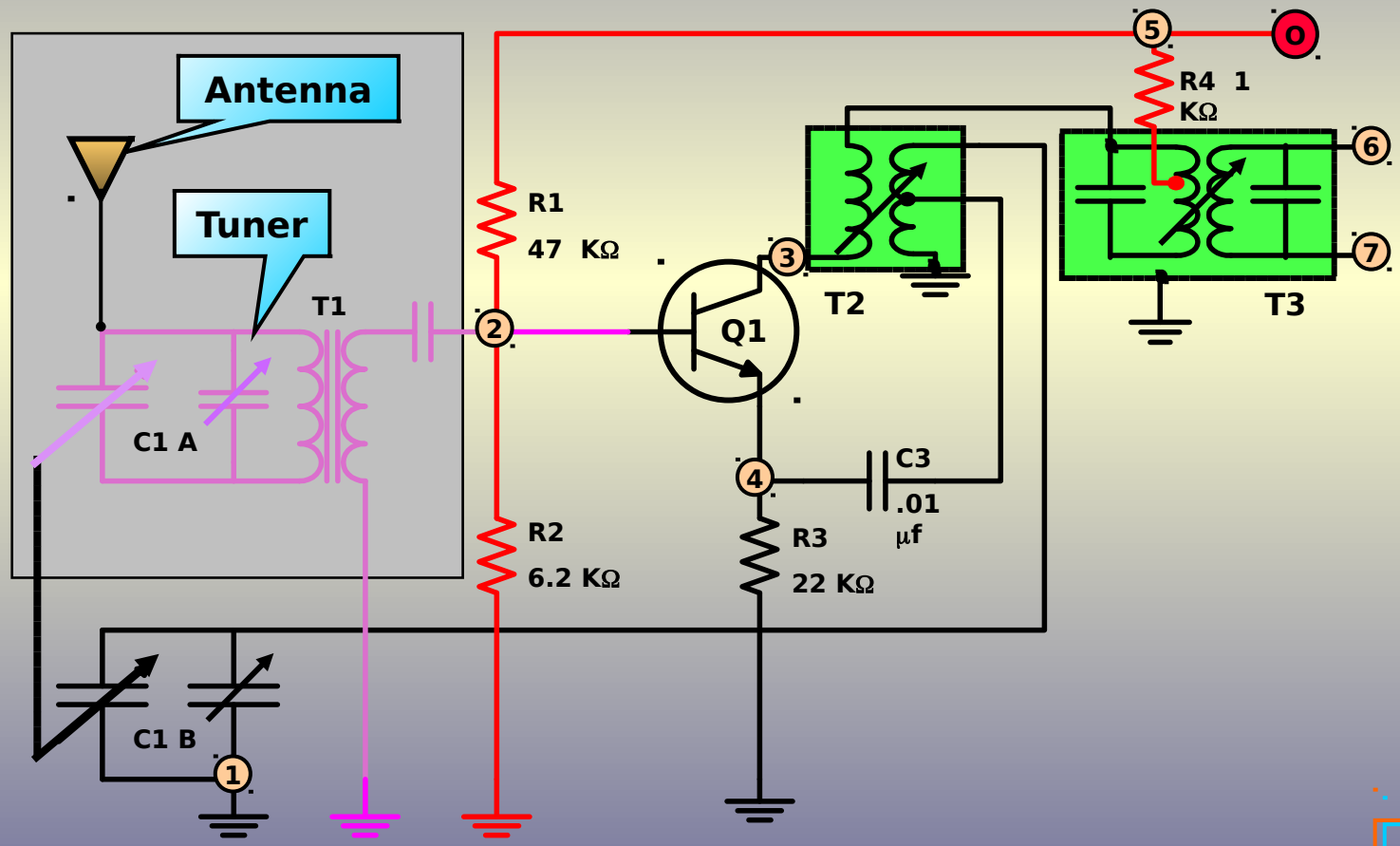
RECEIVER GROUP; PC Antenna & Tuner.

PC
38



Local Osc

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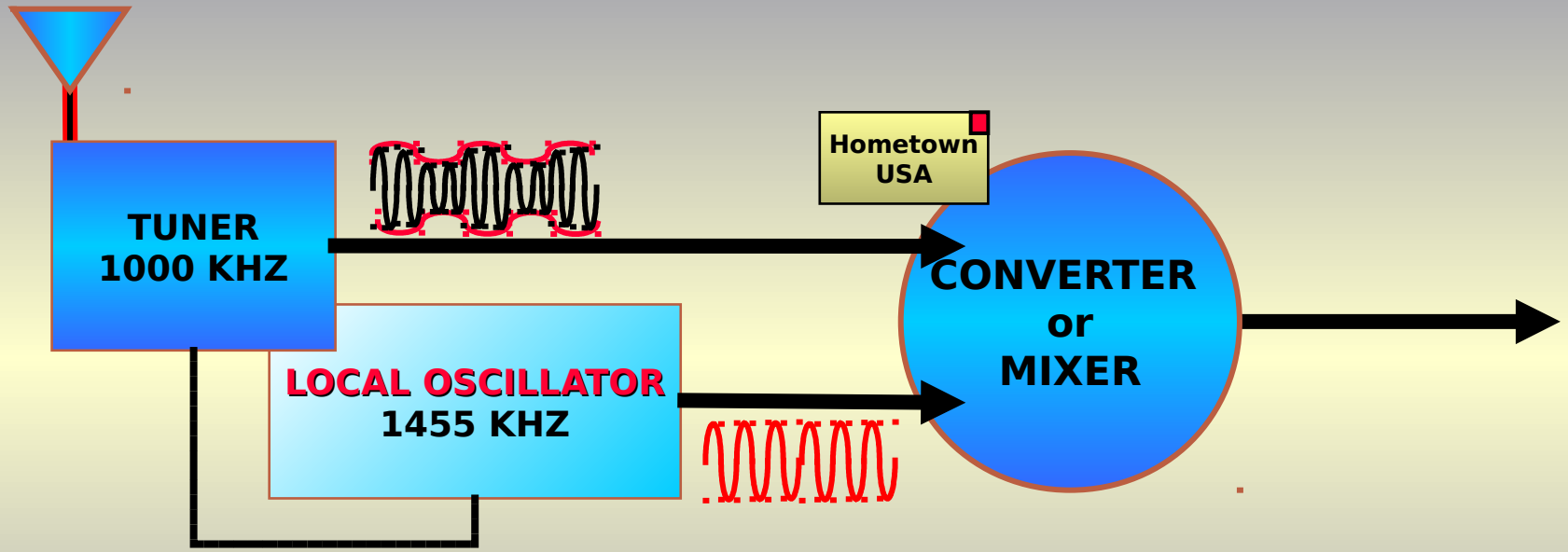
RECEIVER GROUP; Local Oscillator [LO]



1. The LO Signal output is always the Tuner Frequency, Plus 455 KHz Regardless of what AM signal is tuned.
2. It is tuned simultaneously with the RF Tuner.
3. The output would be 1000 + 455 = 1455 KHZ CW.
4. The output of 1455 KHZ is sent to the Converter or Mixer.

PC 38, LO

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RECEIVER GROUP; Local Oscillator [LO]

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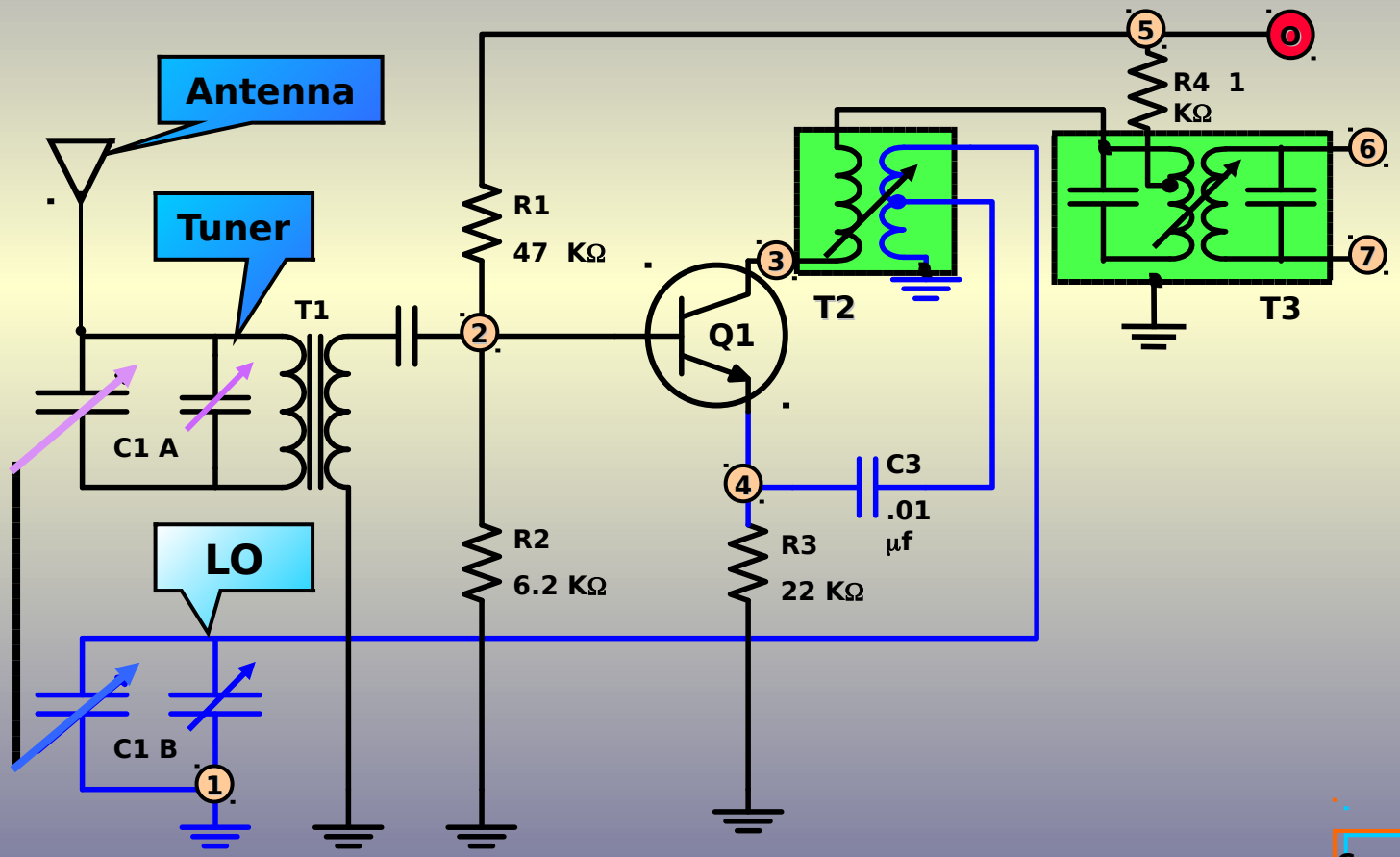

Converter / Mixer

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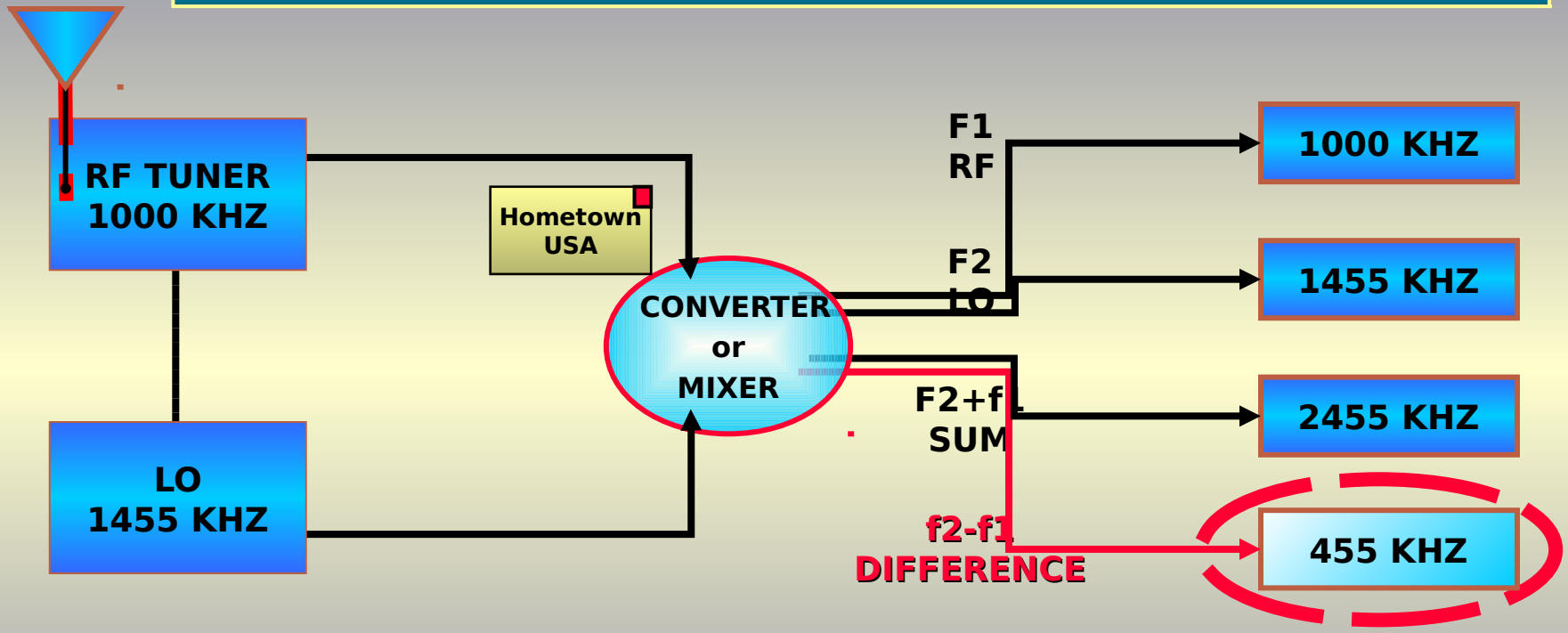
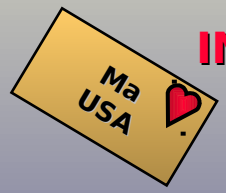
RECEIVER GROUP; Converter / Mixer



The 1000 KHZ from the Tuner is heterodyned with a 2nd signal from the Local Oscillator [1455 KHz] to produce 4 different output frequencies.



INTERMEDIATE FREQUENCY (IF)

PC 38, Mixer

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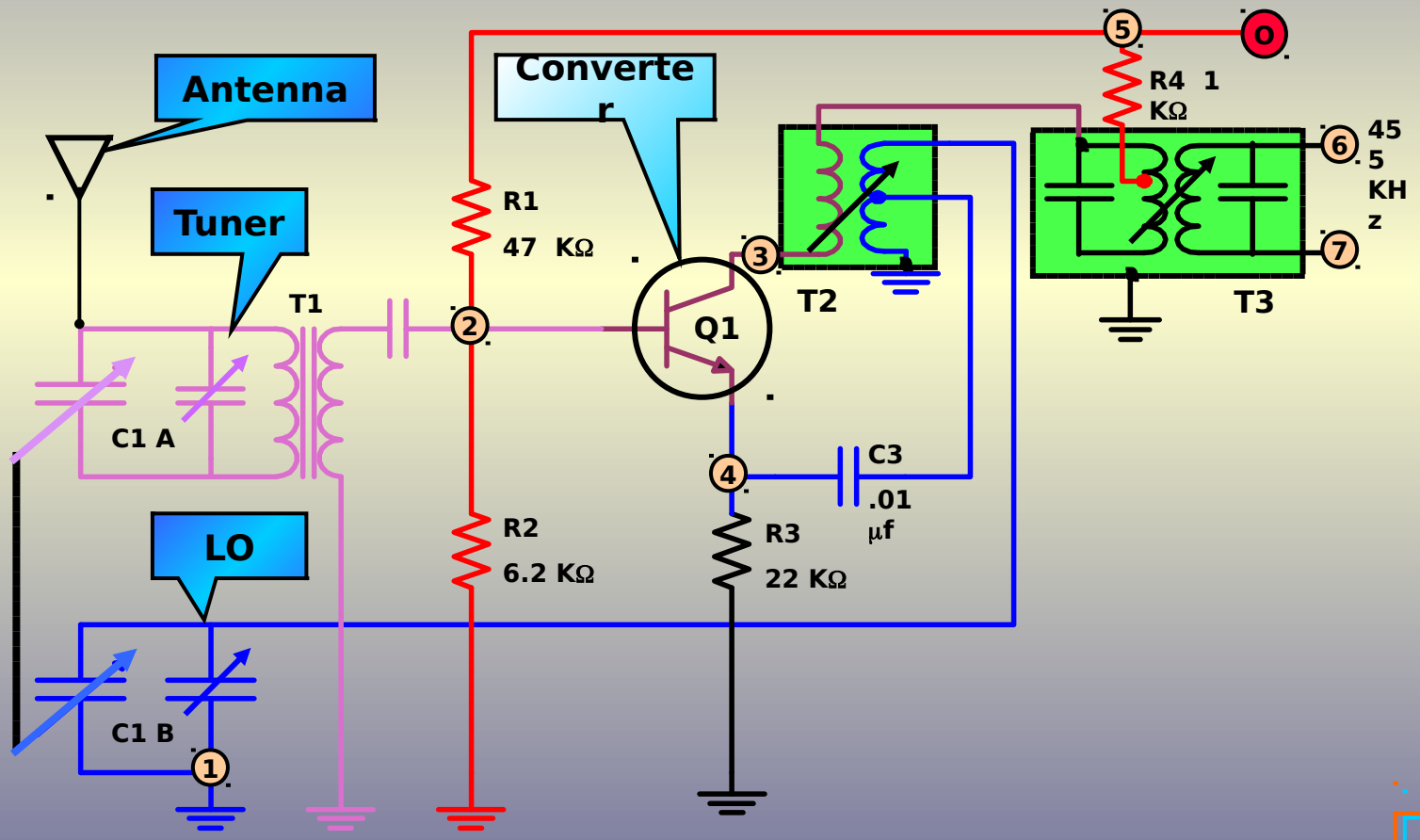
RECEIVER GROUP; Converter / Mixer

PC 38



IF Amp

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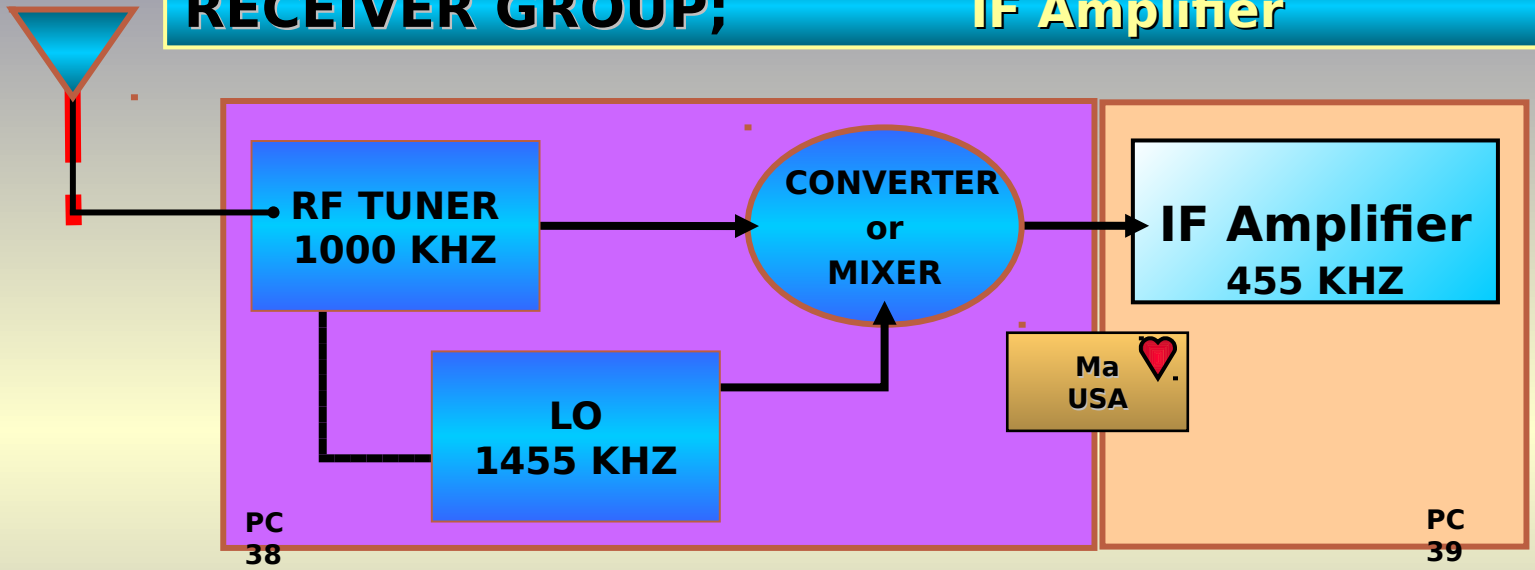
RECEIVER GROUP; IF Amplifier



IF amplifier has the most receiver gain and is made up of 2 cascaded high gain amplifiers tuned to 455 KHZ.

Sensitivity and bandwidth [T4 & 5] are determined by this stage.

The [IF] output is sent to the detector (demodulator).

PC 39, IF Amps

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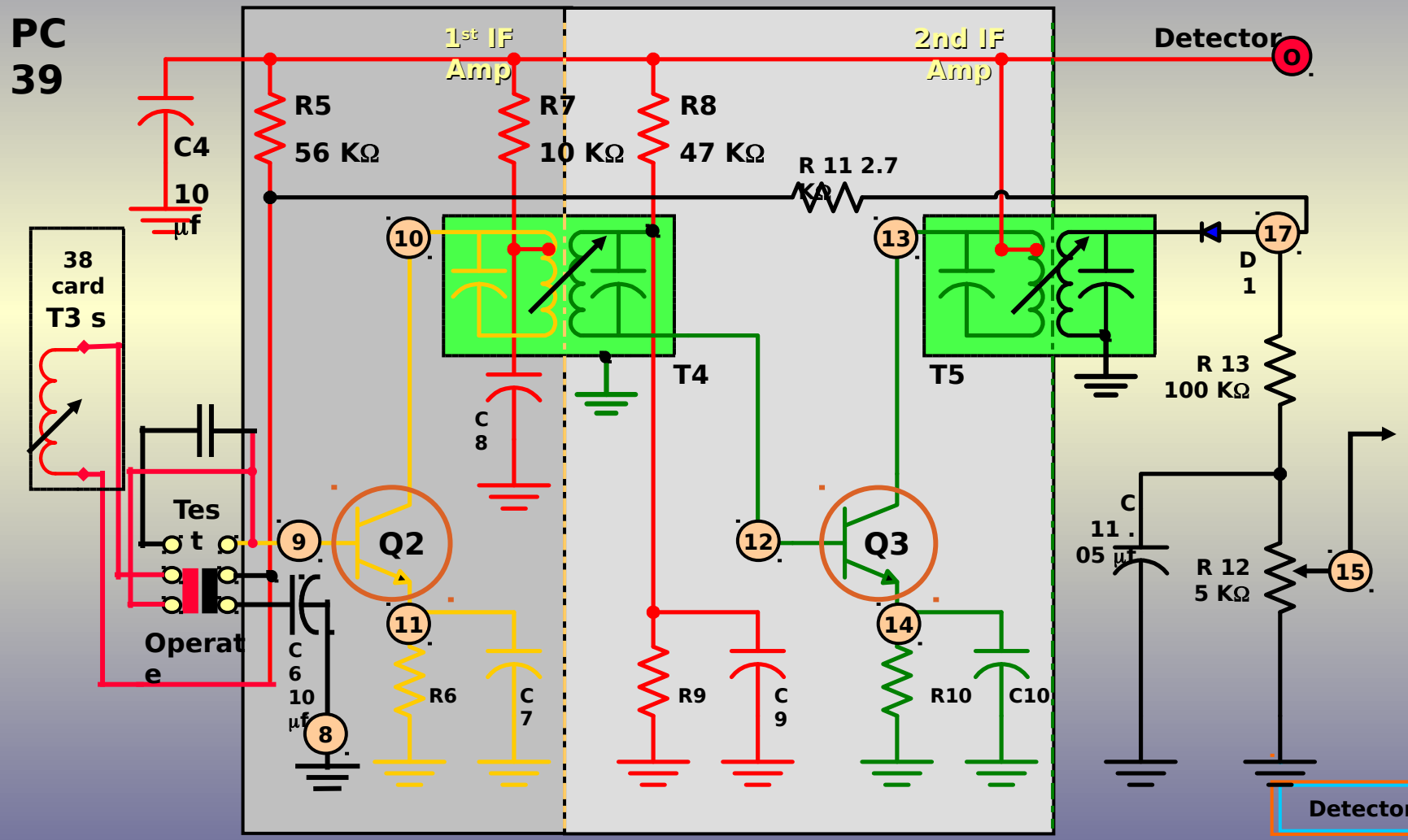
RECEIVER GROUP; IF Amplifiers



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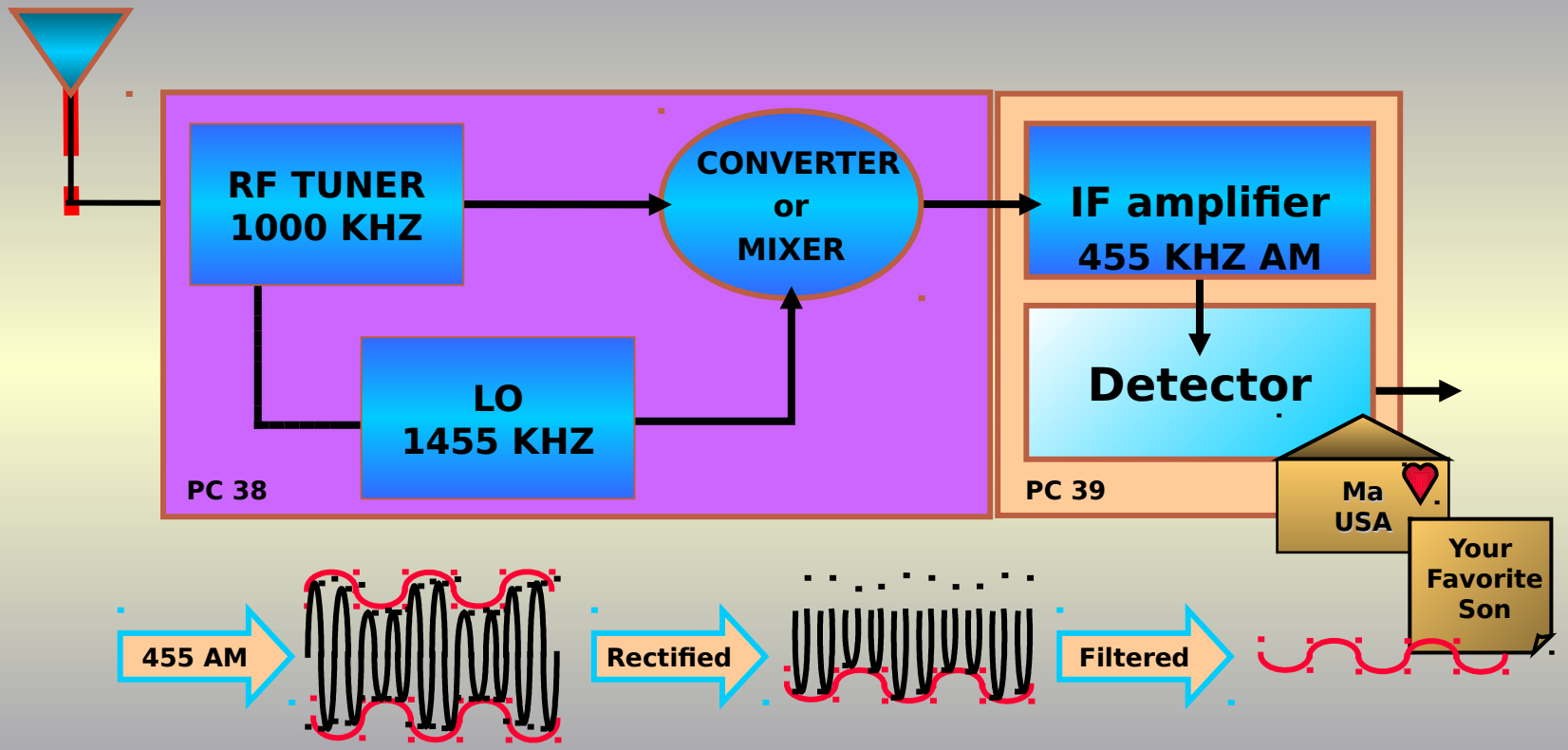
RECEIVER GROUP; DETECTOR OR DEMODULATOR



Rectifies the modulated signal, then filters out the 455 KHz Leaving only the audio frequency or intelligence of 50 Hz – 20 KHz
Which is sent to the AF amplifiers.

PC 39 Detector

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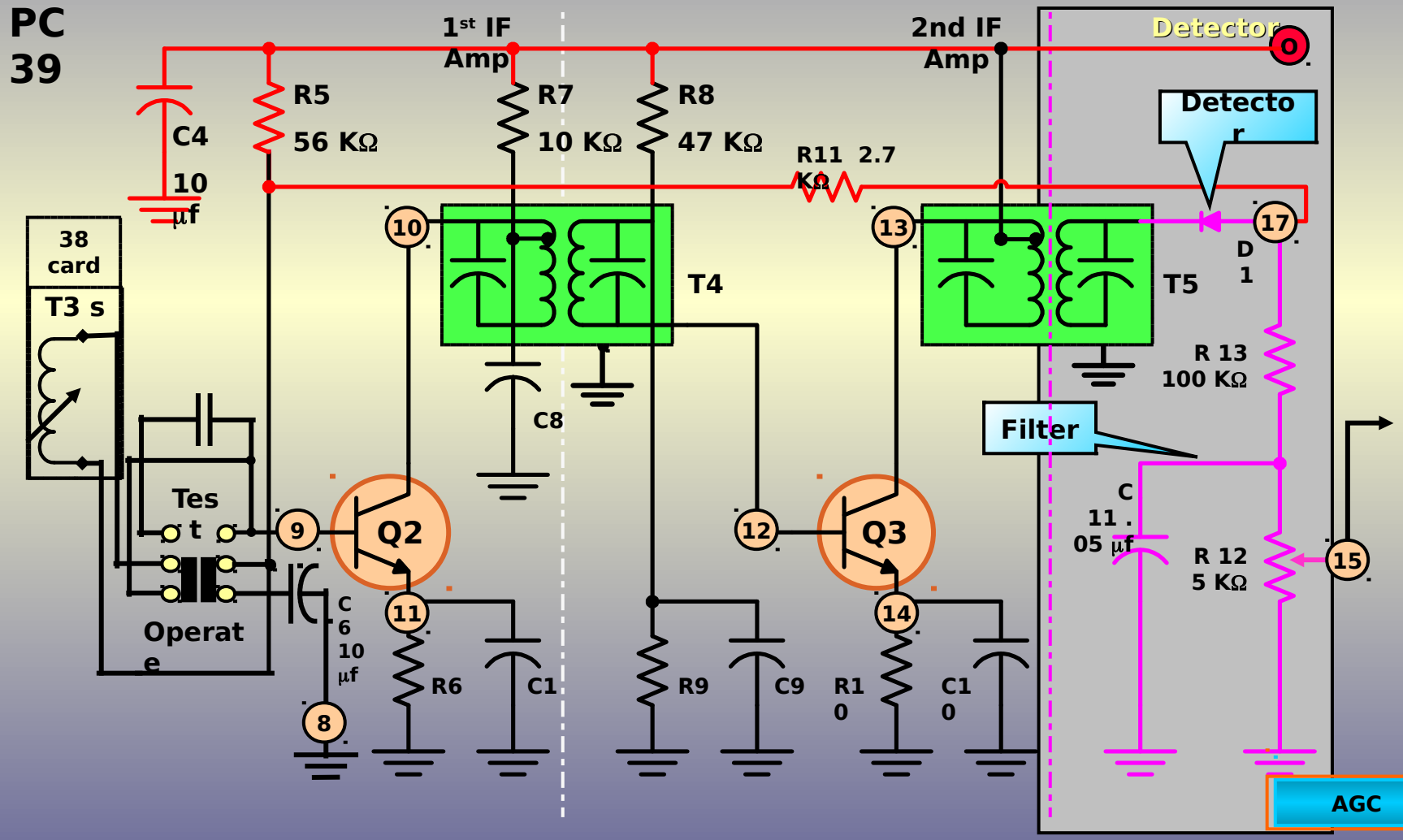
RECEIVER GROUP; DETECTOR or DEMODULATOR



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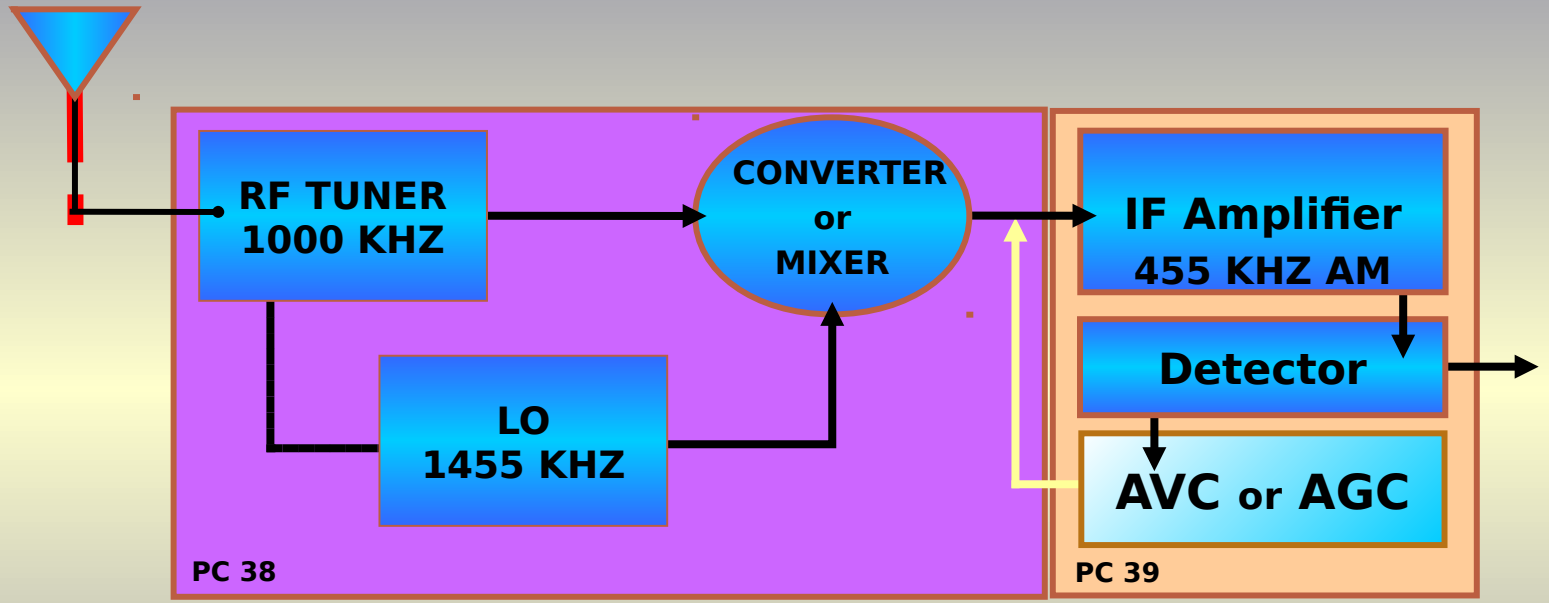
RECEIVER GROUP; AVC or AGC



<u>Automatic Volume Control</u> or gain control is taken at the detector (demodulated and fed back to the first IF amplifier base. Required to overcome atmospheric and terrain conditions that adversely affect signal strength between the transmitter & receiver.

PC 39, AGC

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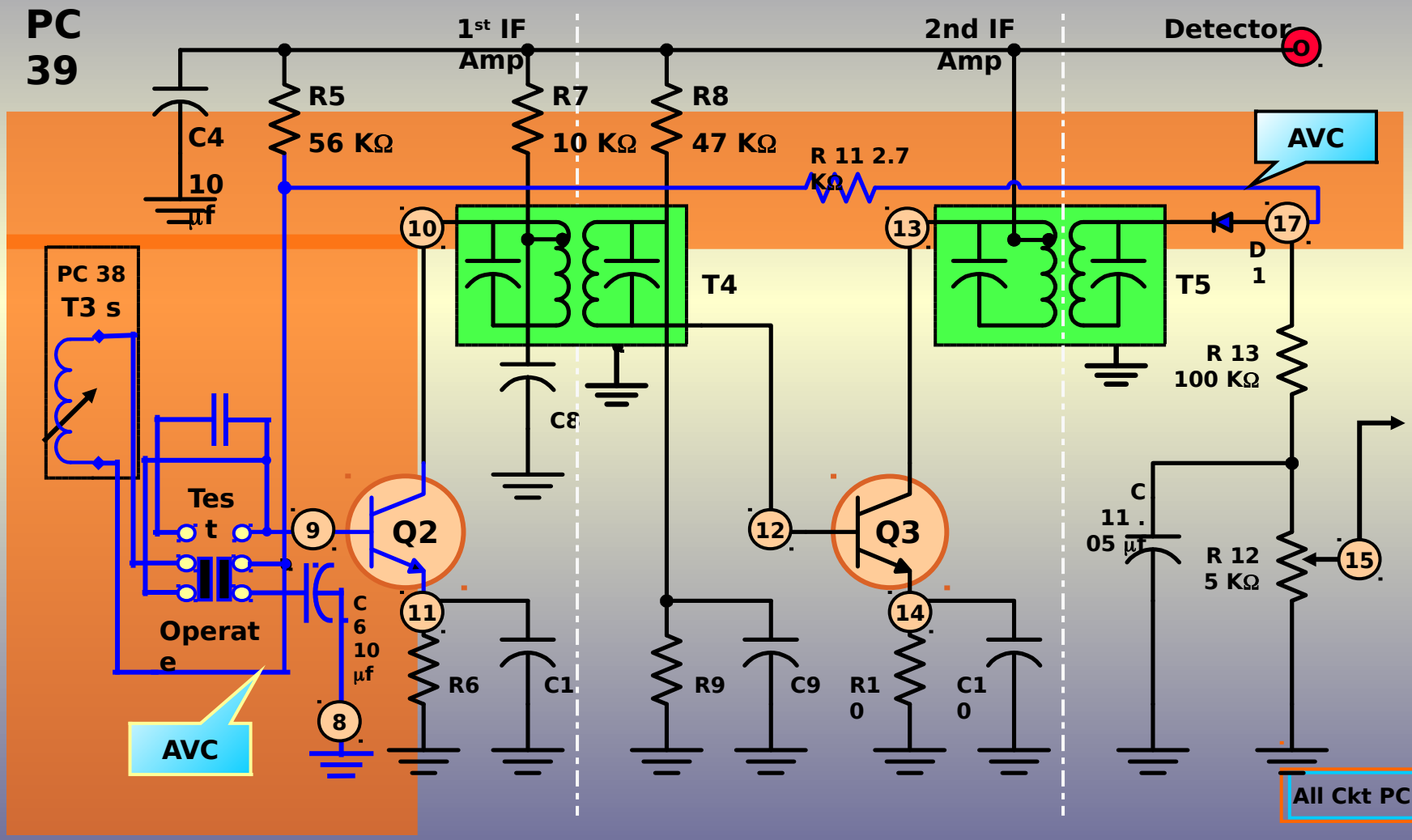
RECEIVER GROUP; AVC or AGC



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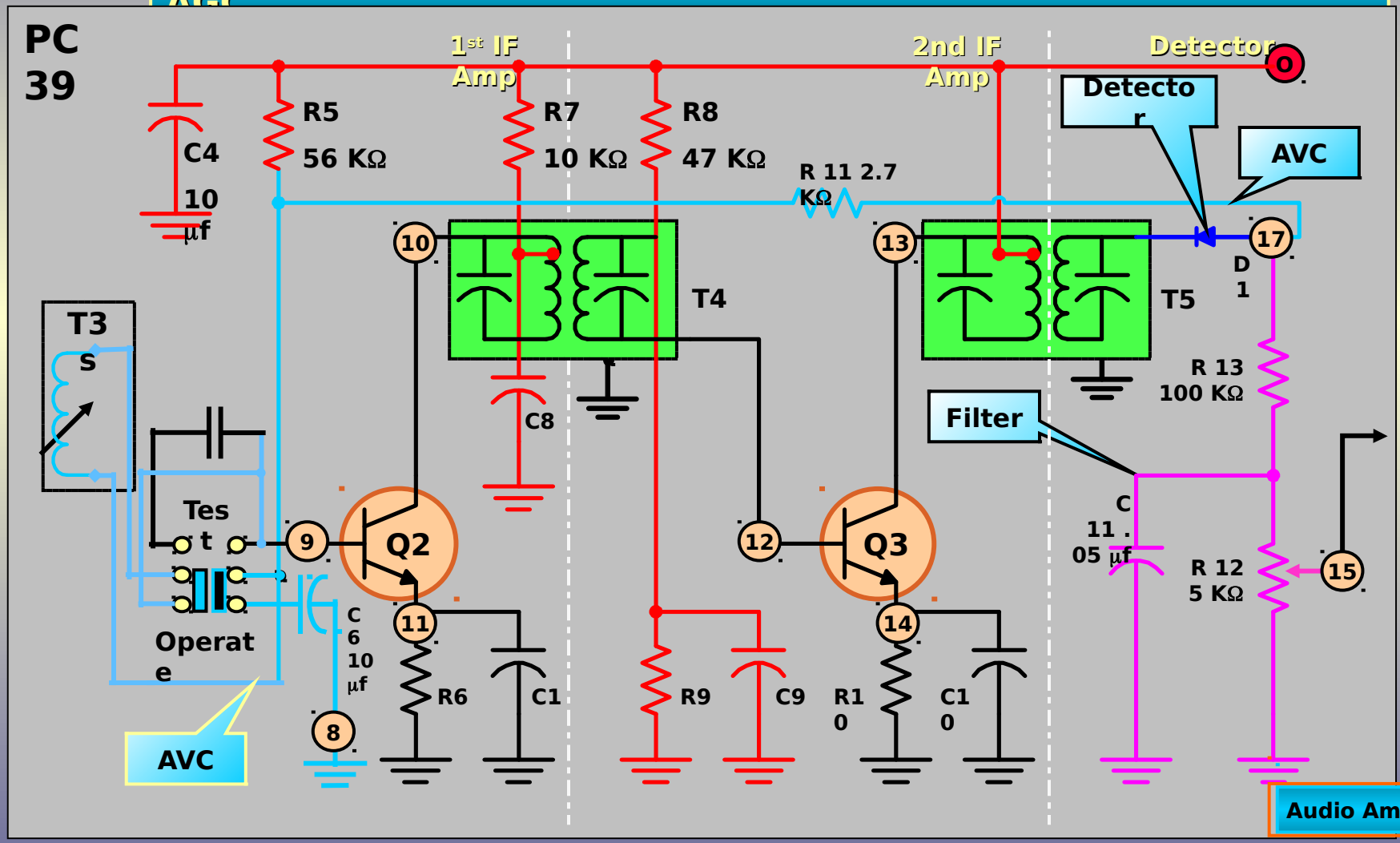
RECEIVER GROUP; 1st & 2nd IF Amp, Detector, AVC or AGC



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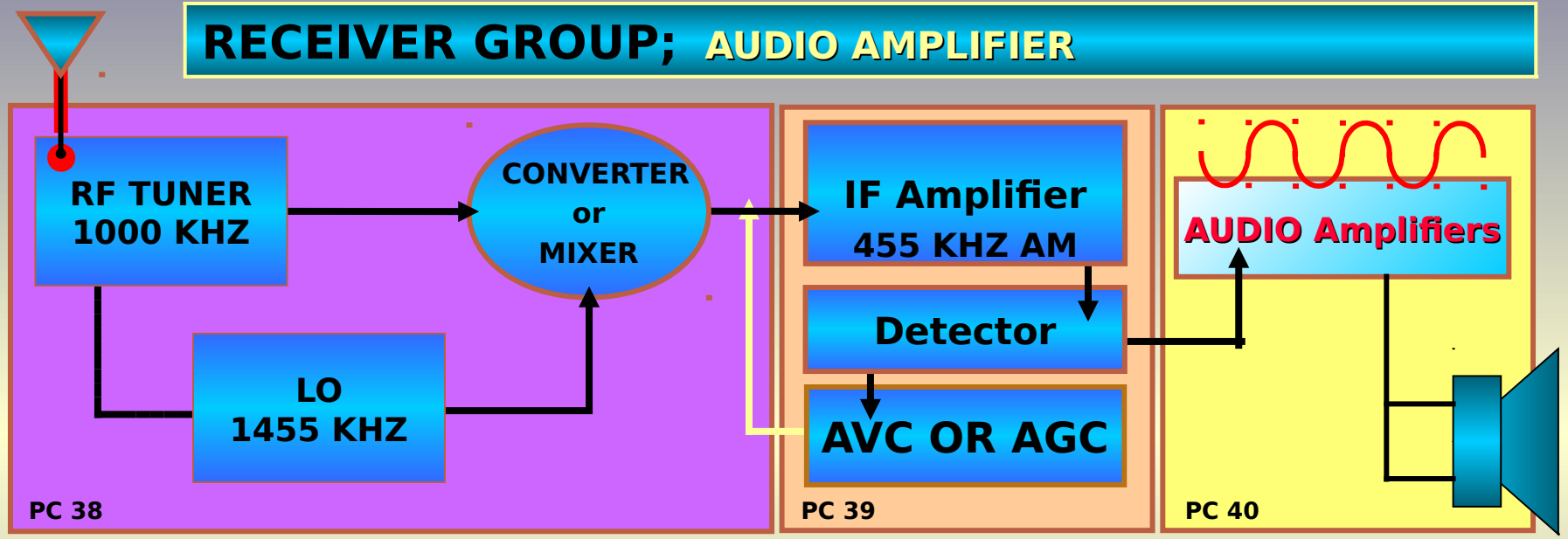
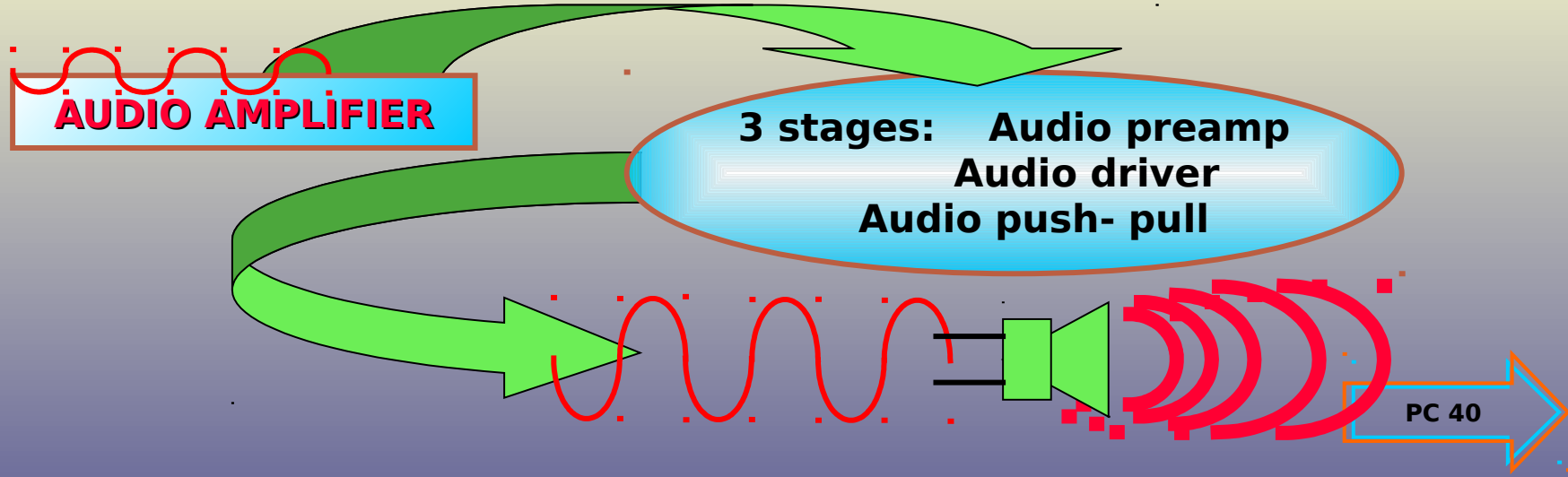
RECEIVER GROUP; AUDIO AMPLIFIER





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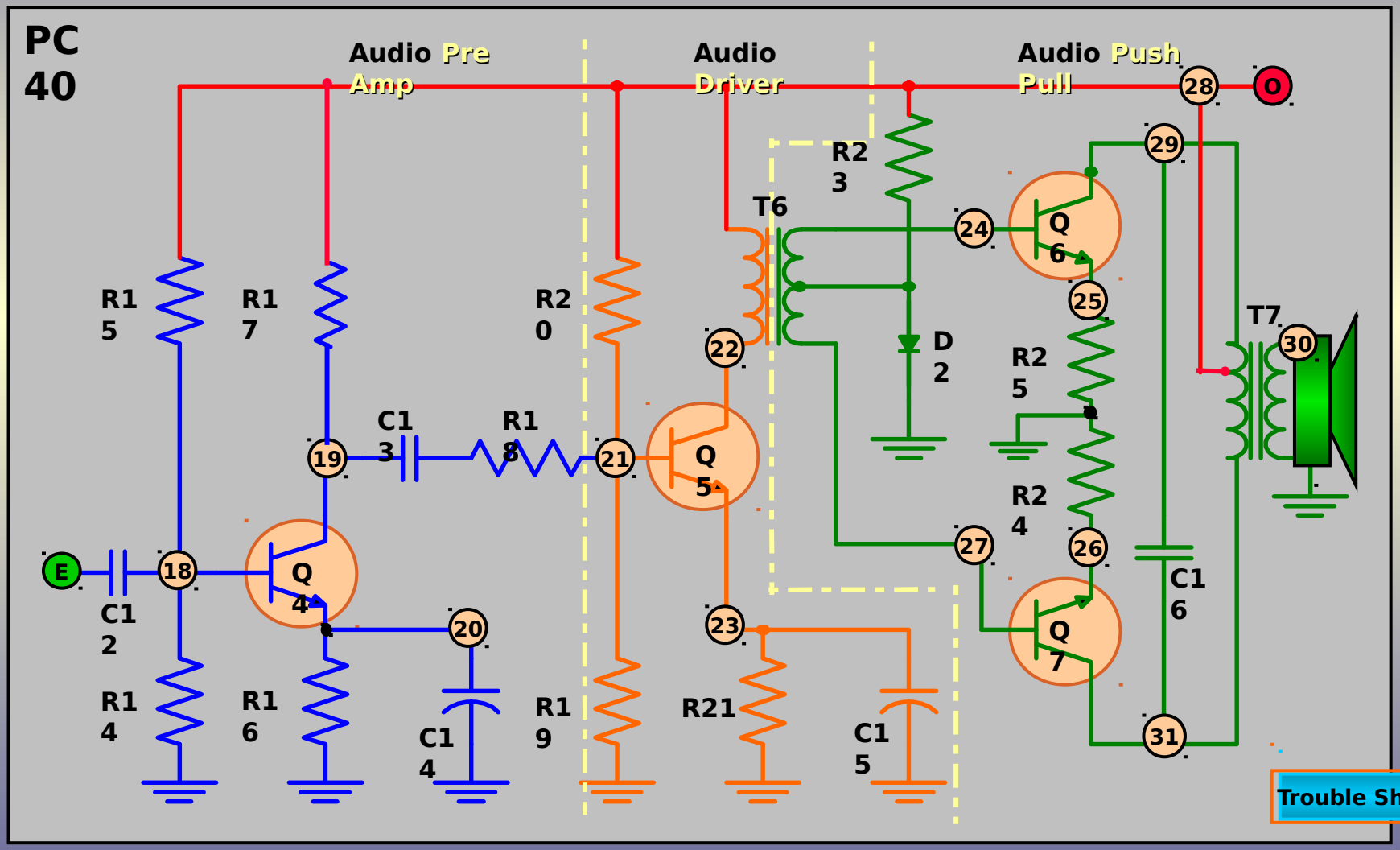
RECEIVER GROUP; AUDIO AMPLIFIER



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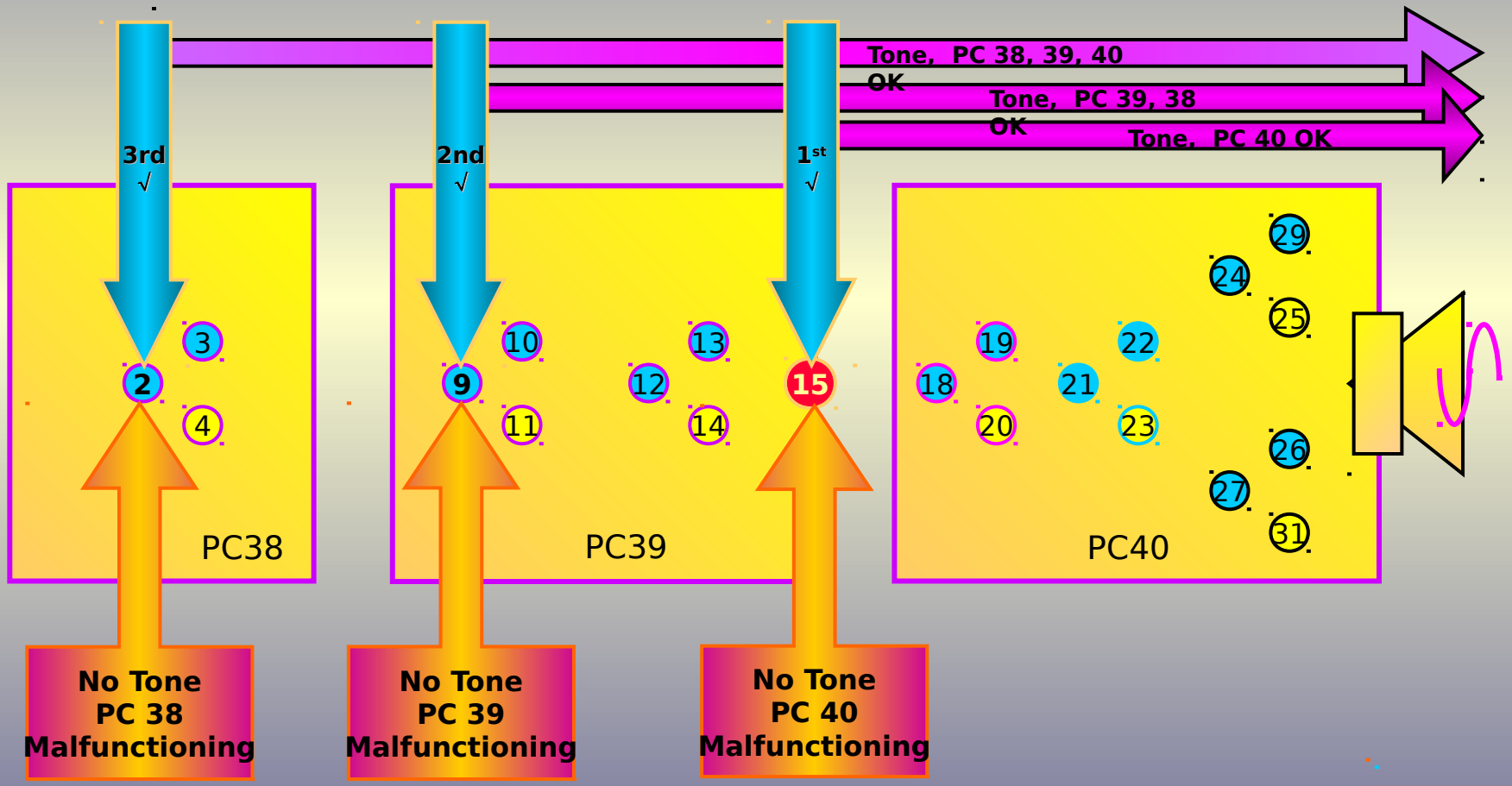
RECEIVER GROUP; Trouble shooting procedure.



Lesson Test

TIII: SUPERHETERODYNE RECEIVER

Review Questions;

1. Where does heterodyning take place in the receiver taught? _____
2. The IF amplifier is tuned to the _____ frequency of _____ KHz.
3. What are the block diagram stages of a Super heterodyne receiver?

   _____ _____ _____

   _____ _____ _____

   _____ _____
4. What components make up the Local Oscillator & Feedback? ___, ____, ____.
5. What is the propose of the AVC [AGC] Ckt in the receiver? _____
6. What are the two actions needed to Demodulate an AM carrier?

   _____, _____.
7. What type of coupling is used in the RF & IF section of the Super-Het-Receiver discussed in this lesson? _____
8. T6 Secondary in the audio amplifier is center tapped to provide 2 signals that are the _____ in amplitude and the _____ in polarity.
9. What is the purpose of Q5 Driver Amp in PC 40? _____

Answers 1-9

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Review Questions;

10. What is the frequency range of a standard AM broadcast receiver? _____
11. Frequency conversion can handled by two stages, or only one. What are they called? _____ , _____ .
12. After a receiver is properly aligned, it should have maximum _____ & _____
13. What is the frequency of the Local Osc, [LO] ? _____
14. What is the main use of the Audio output Transformer [T7] ? _____ _____
15. What section of a super heterodyne receiver provides the most gain? _____
16. Where & what is the first test in troubleshooting an inoperative receiver ? _____ , _____ _____
17. When troubleshooting the superhet receiver, which section [card] do you check first? _____ _____
18. What is the purpose of Cr1 [D1] ? _____ _____
19. When aligning the super heterodyne receiver , Which section is aligned first ? _____ ___ _____
20. What method of troubleshooting is used on the super heterodyne receiver ? :

Answers 10- 21

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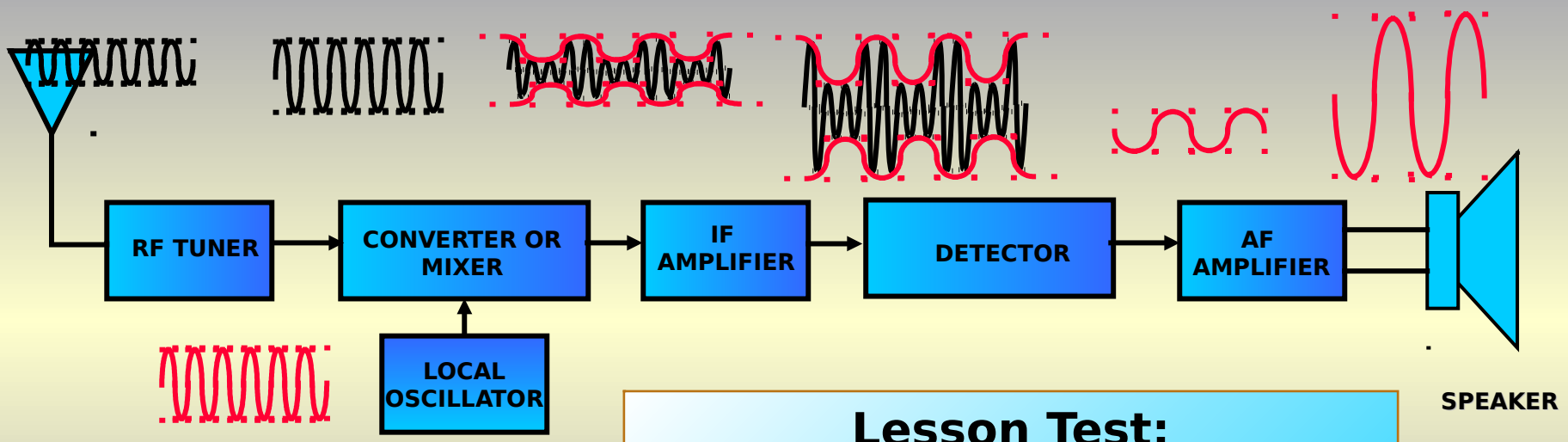
Lesson Test;



Lesson Test:

Standard:

10 Questions W/in 20 Minutes.

70% Minimum Accuracy.

Reference: NONE

PE Write UP

PE Set UP

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PE Write Up; Example 1.

Card	TP	Indication	Test Equip
39	TP 15		F-Gen
39	TP 9		F-Gen
38	TP 2		F-Gen
38	TP 3	11.89 VDC	DMM
38 DMM	TP 2	280mVDC	
38 DMM	TP 4	280mVDC	
38	TP 2/4	0/0 Ω	DMM

Card: 38
Circuit: LO
Component: Q1
Malfunction: Short

PE Write UP

CE

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PE Write Up; Example 2.

Card	TP	Indication	Test Equip
39	TP 15		F-Gen
39	TP 9		F-Gen
39	TP 12		F-Gen
39	TP 10	12 VDC	DMM
39 DMM	TP 9	780mVDC	
39 DMM	TP 11	220mVDC	
39	TP 10/9	Hi/Hi Ω	DMM

Card: 39
Circuit: 1st IF AMP
Component: Q2
Malfunction: Open

PE Set UP

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